

PRODUCT BROCHURE

ViaCon Pecor Optima



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VIACON

ViaCon Pecor Optima* system is widely used in civil engineering

- Roads and railway culverts
- Ecological passages (for animals)
- Forestry culverts
- Relining of existing old culverts
- Ventilating system
- Agricultural ventilation

Advantages of using Pecor Optima

- No need to use heavy equipment for installation
- Versatile system due to wide range of fittings
- Fast and easy assembly (lightweight)
- Low transportation costs
- Optimal strength and hydraulic parameters
- No corrosion concerns

Technical approvals

Pecor Optima pipes have the following documents:

- Technical Approval issued by Polish Road and Bridge Research N° KOT- 2017/0024 issue 4 [2]
- Positive opinion from Polish Central Mining Institute (GIG) for use of pipes on subsidence areas [3]
- Technical Approval issued by Romanian Ministry of Regional Development and Public Administration N° 004-07/1599-2019 [3]



APPLICATION

Pecor Optima's exceptional, helically corrugated double wall pipes with a smooth inside are used for building and relining culverts and stormwater pipeline systems. The unique structure of Pecor Optima pipes is a result of Scandinavian long-term experience in culvert and pipe technology.

According to the latest information from PPI (Plastic Pipes Institute) corrugated pipes produced of polyethylene can be designed to have a 100-year lifetime.

The Pecor Optima system is widely used in civil engineering. Due to fast assembly and very good strength and hydraulic parameters, the system has received wide recognition among designers

and contractors. Unique spiral structural walls allow optimal stress distribution along the whole pipe length and ensure the proper ring stiffness on each section. The smooth inside wall of Pecor Optima pipes allows for good hydraulic parameters.

Pecor Optima pipes can be used as curved in plane and profile.

A broad range of fittings (elbows, T-pipes, reductions) make up a complete system.



MATERIAL

Raw material used to produce Pecor Optima pipes is high density polyethylene (HDPE).

Mechanical and physical characteristic properties are provided below:

- Density $>0,942 \text{ [g/cm}^3\text{]}$
- Young modulus:
 $E_{\text{short-term}} = 600 \div 1000 \text{ [MPa]}$
 $E_{\text{long-term}} = 150 \div 300 \text{ [MPa]}$
- Ultimate elongation: $> 600 \text{ [%]}$
- Melt flow index MFI: $0,15 \div 0,60 \text{ [g/10min]}$ for loading 2,16 kg
- Coefficient of linear thermal expansion: $\alpha = (1,5 \div 2,0) \times 10^{-4} \text{ [1/}^\circ\text{C]}$
- Working temperature range: $-30 \div +75 \text{ [}^\circ\text{C]}$

There is a mixture of polyethylene and black colouring dye stabilised on UV radiation used for Pecor Optima production.

STRENGTH

Standard Pecor Optima pipes are produced in the following classes of ring stiffness:

- SN 4 (4 kPa) - pipes 1400 mm
- SN 6 (6 kPa) - pipes from 300 mm to 1400 mm
- SN 8 (8 kPa) - pipes from 300 mm to 1200 mm
- SN 10 (10 kPa) - pipes from 300 mm to 1200 mm

STANDARDS LENGTH OF Pecor Optima PIPES

The standard lengths of Pecor Optima pipes are $L = 6 \text{ m}, 7 \text{ m}, 8 \text{ m}$ for all classes.

Depending on the stiffness class the production process allows for production of pipes with up to 12 m length.



HIGH RESISTANCE TO MOST CHEMICAL COMPOUNDS

High Denisty Polyethylene (HDPE) is characterised by high resistance to most chemicals. Table 1 gives an overview of the resistance of polyethylene to various chemicals.

- S - sufficient resistance
- L - limited resistance
- I - insufficient resistance

Table 1. HDPE (High Denisty Polyethylene) - chemical resistance

Material	Concentration	20°C	60°C
Acetone	100%	L	L
Acetaldehyde	100%	S	-
Ethyl alcohol	96%	S	S
Isopropyl alcohol	100%	S	S
Methyl alcohol	100%	S	S
Aqueous ammonia solution	Diluted solution	S	S
Aniline	100%	S	L
Nitrates	Saturated solution	S	S
Benzene	100%	L	I
Gasoline (aliphatic hydrocarbons)	-	L	L
Chlorine	Gas	L	I
Chlorates	Saturated solution	S	S
Cyclohexanol	10%	S	S
Detergents	2%	S	S
Phenol	90%	S	S
Formaldehyde	40%	S	S
Xylene	100%	L	I
Nitric Acid	25% to 70%	S	L
Hydrochloric acid	< 36%	S	S
Lactic acid	10% to 90%	S	S
Formic acid	2% to 100%	S	S
Acetic acid	25%	S	S
Acetic acid	> 96%	S	L
Sulphuric acid	10% to 90%	S	S
Sulphuric acid	98%	S	L
Potassium hydroxide	Unsaturated solution	S	S
Hydrogen sulphide	Gas	S	S
Sodium hydroxide	Saturated solution	S	S
Toluene	100%	L	I
Hydrogen peroxide	30%	S	S

S - sufficient resistance

L - limited resistance

I - insufficient resistance

CONSTRUCTION OF Pecor Optima

Pecor Optima pipes are produced with double wall, smooth inside and corrugated outside.

The corrugation is stiff and can interact with surrounding soil. The corrugation size and the distance between corrugation depends on the diameter of the pipe (the bigger dimension, the larger corrugation).

Corrugation detail of Pecor Optima pipes is shown. The dimensions and the tolerances are presented in Table 2.

The dimensions and tolerances of Pecor Optima

Item	Nominal diameter DN [mm]	Outside diameter OD [mm]	Inside diameter ID [mm]	Area [mm ²]	Period of corrugation P [mm]
1	300	304 ± 6 mm	363 ± 6 mm	0,07	55,5
2	400	400 ± 8 mm	478 ± 8 mm	0,13	74,0
3	500	506 ± 10 mm	594 ± 10 mm	0,20	92,0
4	600	608 ± 12 mm	722 ± 12 mm	0,28	108,0
5	800	800 ± 15 mm	970 ± 15 mm	0,50	140,0
6	1000	994 ± 15 mm	1170 ± 15 mm	0,79	142,0
7	1200	1194 ± 15 mm	1374 ± 15 mm	1,13	142,0
8	1400	1389 ± 15 mm	1570 ± 15 mm	1,54	142,0

Table 2. Nominal diameter (DN) of Pecor Optima pipes refer to inside diameters (ID)

Pecor Optima culvert pipes

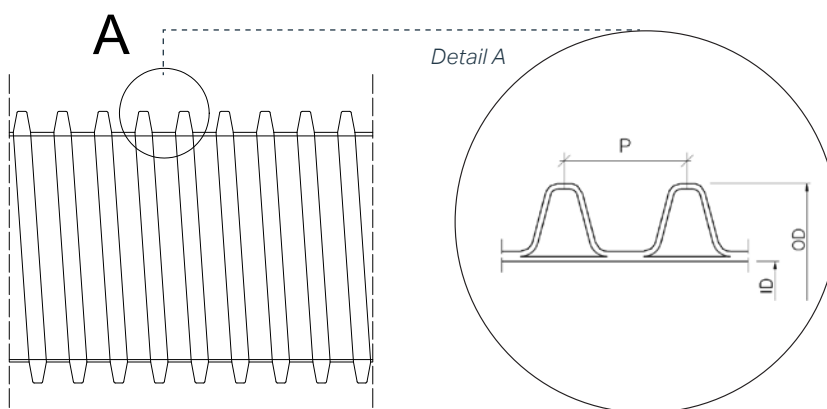
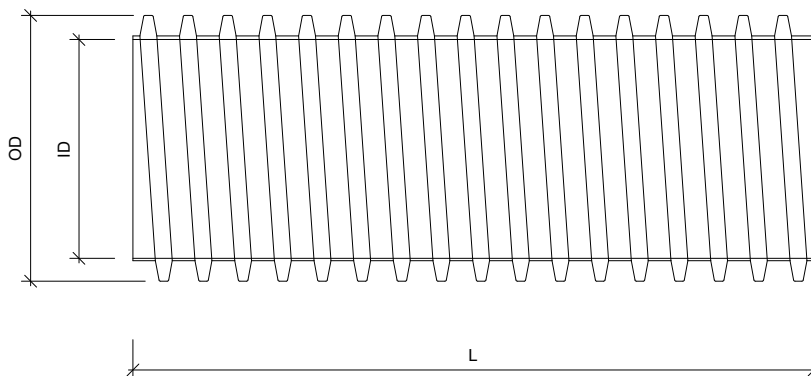
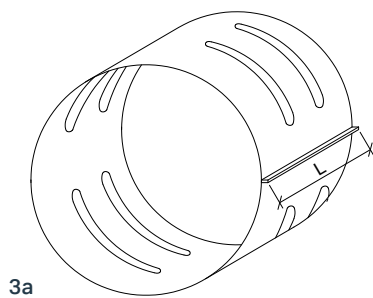


Fig. 1. Construction of Pecor Optima.

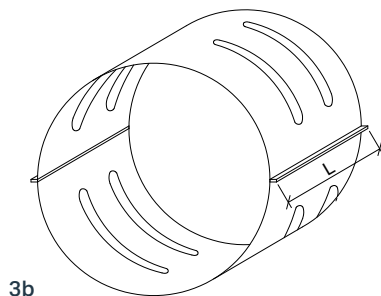
Fig. 2. Corrugation detail A.

CONNECTION OF Pecor Optima PIPE

Pecor Optima pipes are joined with coupling bands. They are available as one-piece bands (Fig. 3a), and in two-piece bands (Fig. 3b). Pecor Optima pipes including coupling bands make up a sand-tight system.



3a



3b



PIPE END FINISHINGS

Using Pecor Optima pipes enable an accurate adjustment of both ends slope and required angle.

Bevel cut can be done on one or both sides with full bevel or step bevel.

It is recommended to use a vertical step of 1/3 the height of the pipe.

THERE ARE SEVERAL POSSIBILITIES FOR END FINISHINGS:

Vertical end:

- Reinforced concrete head wall
- Head wall made of gabions

Beveled end:

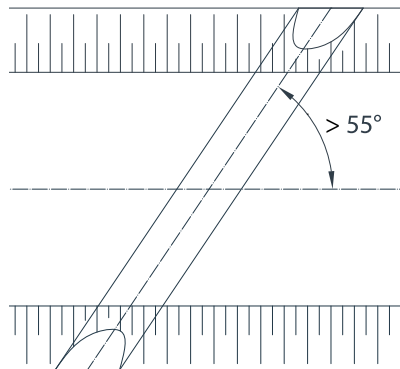
- Slope paved with concrete or stone blocks placed on sand-cement
- Slope paved with perforated concrete panels
- Slope paved with stone rip rap
- Reinforced concrete collar

It is recommended to pave the invert of the culvert. Concrete blocks, stone, gabions or other available material can be used.

Skewed less than 90° end can be made for both vertical and beveled ends. Minimum allowable skew angle is 55°.

In special cases it is necessary to make additional reinforcement in the skewed area.

Please contact the ViaCon Technical Department to get more information.



FITTINGS AND COUPLING BANDS FOR ViaCon Pecor Optima PIPES

System consists of:

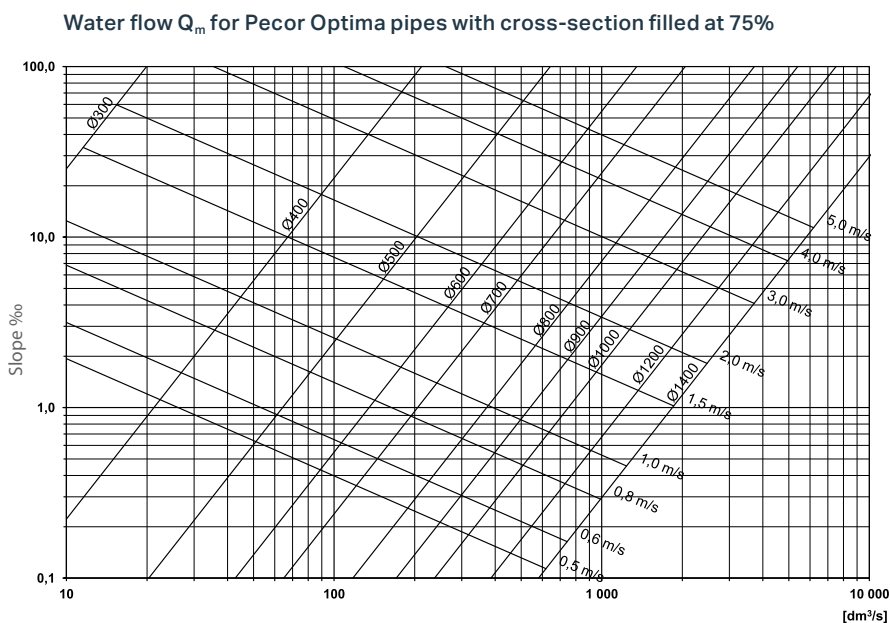
- Coupling bands (full ring, one-piece band, two-piece band)
- Elbow (30°, 45°, 60°, 75°, 90°)
- T-pipes (45°, 90°)

Fittings with other angles are available.



HYDRAULIC PARAMETERS OF Pecor Optima PIPES

Diameters of the pipe should be determined on the basis of hydraulic calculation, depending on expected volume of flow. The figure shows the reference water flow Q_m for Pecor Optima pipes with water flow at 75% height. Water-flow regulations may differ slightly depending on national standards.



Water flow Q_m for Pecor Optima pipes with cross-section filled at 75%.



Pecor Optima M Sewage Manholes – APPLICATION

Manholes are used for:

- Non-pressure sewage systems
- Road dewatering
- Parking lot dewatering

Pecor Optima M manholes are produced in three types:

- Three-way pipe
- Sedimentation tanks
- Eccentric

Pecor Optima M manholes in dimensions ID= 800 mm, 1000 mm, 1200 mm, and 1400 mm are equipped with steps.

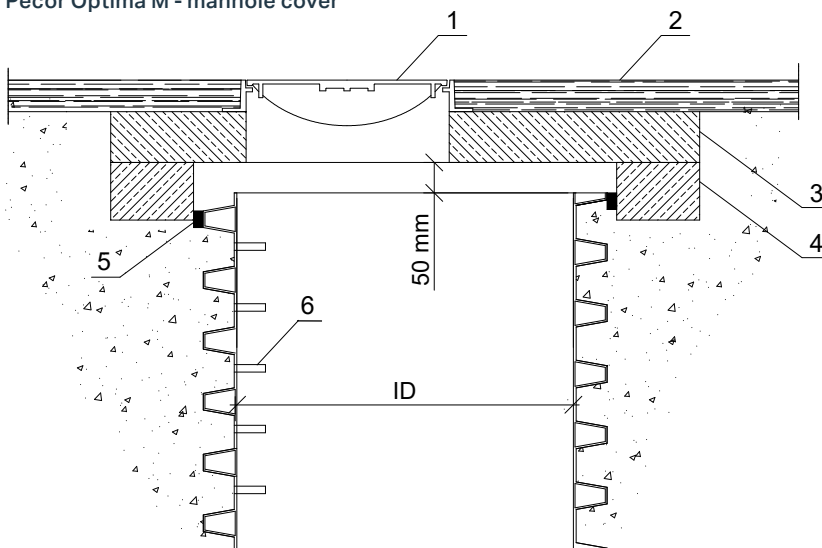
Sewage Pecor Optima M manholes are adopted to connect with cast iron or concrete cover in the appropriate class. The diagram below shows an example of a Pecor Optima M manhole cover.

There are stud couplings on the bottom part of manholes made from Pecor Optima pipes or connector pipes made of HDPE adopted to connect sewage pipes.

The bottom of the Pecor Optima M manhole is made of HDPE plate.

Whole stub pipes and bottoms are connected with the main manhole body pipe by welding.

Pecor Optima M - manhole cover



1. Manhole cover in proper class:
A15÷D400
2. Surface
3. Concrete slab
4. Cover ring
5. Sealing (space between main pipe and reinforced plate)
6. Steps

COVER DEPTH FOR Pecor Optima

Definition of the cover depth for road structures Cover depth can be described as the vertical distance between the top of the culvert and the road grade-line, including the road pavement.

Definition of the cover depth for railway structures Cover depth for culverts under railways can be described as a vertical distance between the top of the culvert and the bottom of the railway sleeper, including the construction layers of the railroad.

In case of construction traffic, the cover depth must be agreed with Technical Department of ViaCon company. Material for bedding and backfill for Pecor Optima pipes

- Gravel, sand-gravel mix, all-in aggregates and crushed stone can be used as bedding and backfill material
- Aggregate grain size depends on size of corrugation profile



Cover depth

Type of structure	Min. cover depth
Cover depth for road structures	$H_{min} = \begin{matrix} \text{DN } 300 \div 500 - 0,3 \text{ [m]} \\ \text{DN } 600 \div 1000 - 0,5 \text{ [m]} \\ \text{DN } 1200 - 0,6 \text{ [m]} \\ \text{DN } 1400 - 0,7 \text{ [m]} \end{matrix}$
Cover depth for railway structures (for live load $\alpha_k=+2$)	$H_{min} = 0,6 \text{ [m]}^*$ * Refer to SN 8



- The maximum recommended size of individual grains at the place of contact with the pipe wall and in its immediate vicinity (approx. $0.3 \div 0.5 \text{ m}$) is 31.5 mm.
- The use of cohesive soil, organic soil and soils included; permafrost is not acceptable

Backfill material around the structure should be placed in uncompacted layers and then compacted:

- Un-uniformity coefficient $C_u \geq 4$
- Curvature coefficient $1 \leq C_c \leq 3$
- Permeability $k_{10} > 6 \text{ m/day}$

- Backfill material should be compacted to minimum 0.98 of Standard Proctor Density, but 0.95 of Standard Proctor Density - in the pipe adjacent

Deviation from these principles requires consultation with the Technical Department of the ViaCon company.

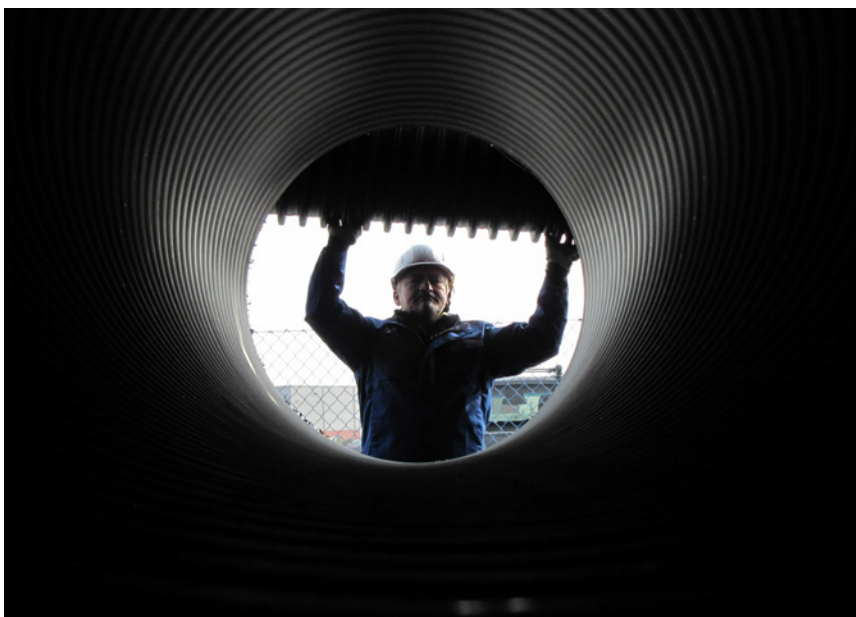
Literature and standards for Pecor Optima

[1] Design and technology guidelines for flexible engineering structures made of plastics. Annex to the Ordinance No. 30 of the General Directorate for National Roads and Motorways, dated 2 November 2006. Bridge and Road Research Institute (IBDiM), Branch in Wrocław

[2] Technical Approval issued by Polish Road and Bridge Research No KOT- 2017/0024 issue 4

[3] Technical opinion of the Central Mining Institute (GIG): „Opinion on the conditions for use of Pecor Optima structured-walls sewerage and culvert pipes in areas affected by mining”, 2007.

[4] Technical Approval issued by Romanian Ministry of Regional Development and Public Administration N° 004-07/1599-2019 [3]



Combining more than three decades of experience with today's cutting-edge technology, ViaCon is a pioneer in the field of Bridges & Culverts, GeoTechnical and StormWater Solutions.

We offer our customers a host of distinct state-of-the-art solutions that are reliable, long-lasting and designed to meet the challenges of a changing world. ViaCon's solutions support both our customers and the society in reaching the vital sustainable goals.

Comprehensive local market know-how combined with the strengths of the group makes ViaCon your partner of choice.



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ViaCon is a leader in infrastructure construction solutions. Built on strong Nordic roots, ViaCon embodies a practical, human perspective that brings together technology and verifiable sustainability. The long-term view defines our vision, and by driving smart, future-friendly construction solutions for bridges and culverts, geotechnical and stormwater solutions, we will continue to shape and lead our industry.

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